

~~QUESTION ONE~~

(2) $E = \pi L = \frac{I}{r^2}$

From the above,

$E = \pi L$ and

$L = \frac{E}{\pi}$

Considering the Reflection Factor,

L becomes

$L = \frac{E}{\pi} \times \text{Reflection factor}$

$L = \frac{44,000 \times 85}{\pi \times 150} = \frac{3740000}{314.2}$

$L = 11.905 \times 10^3 \text{ cd/m}^2$

(5) The flux emitted by the source is..

$\Phi = I \times \omega = 120 \times 12.568$
 $= 1508.16 \text{ Lumen}$

Flux emitted by globe (30% is absorbed)

$\frac{1508.16 \times 30}{100} = 452.448$

Flux emitted by the globe = $1508.16 - 452.448$
 $= 1055.712 \text{ lumen}$

Luminance = $\frac{\text{Flux emitted}}{\text{Area}} = \frac{1055.712}{\pi \times 0.22^2} = 6942 \text{ Lumen/m}^2$

$$\textcircled{c} \quad A = 75 \times 10^{-4} \text{ m}^2 = 75 \text{ cm}^2$$

$$t = 2 \times 10^{-2} \text{ m} = 2 \text{ cm}$$

$$\text{heat required} = mc\Delta\theta$$

$$\text{Density} = \frac{m}{V} \quad ; \quad m = \text{Density} \times \text{Volume}$$

$$m = 0.55 \times (75 \times 2)$$

$$= 82.5 \text{ g}$$

$$C = \epsilon_0 \epsilon_r A = \frac{8.85 \times 10^{-12} \times 6.5 \times 75 \times 10^{-4}}{2 \times 10^{-2}} = 21.57 \times 10^{-12} \text{ F}$$

$$W = 2\pi f = 2 \times \pi \times 20 \times 10^6$$

$$= 125.664 \times 10^6 \text{ rad/s}$$

$$\text{P.F.} = \cos \phi = 0.04$$

$$\phi = 87.7$$

$$\delta = 90 - \phi = 90 - 87.7 = 2.3^\circ$$

$$\text{Heat required} = mc\Delta\theta$$

$$= 82.5 \times 0.255 \times (80 - 30)$$

$$= 1051.88 \text{ cal}$$

$$\text{Total heat required} = 1051.88 \times \frac{85}{100} = 894.098 \text{ cal}$$

$$1 \text{ cal} = 4.186 \text{ (w.s) J}$$

$$894.098 = x$$

$$\text{power input} = 894.098 \times 4.186$$

$$= 3742.7 \text{ (w.s)}$$

$$P = \frac{\text{Energy}}{\text{Time}} = \frac{37427}{8760} = 7.797 \text{ W}$$

$$P_0 = V^2 \omega C \tan \delta$$

$$7.797 = V^2 \times 125.664 \times 10^6 \times 21.57 \times 10^{-12} \times \tan 2.3$$

$$V^2 = \frac{7.797}{1.08868 \times 10^{-4}}$$

$$V^2 = 71618.84117$$

$$V = \sqrt{71618.84117}$$

$$V = 267.62 \text{ V}$$

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$$P = IV \cos \phi$$

$$I = \frac{7.797}{267.62 \times 0.04}$$

$$= 0.7284 \text{ A}$$

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